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## **EUROPEAN PATENT APPLICATION**

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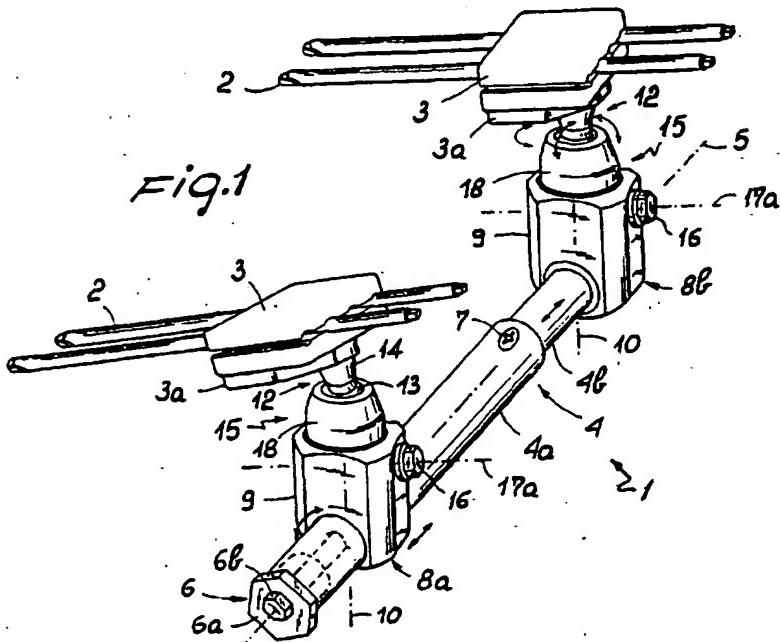
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## (54) External fixator for orthopaedics and traumatology

(57) There is disclosed a fixing device comprising: a bar (4), at least one turret-like support (8a) having an outer casing (9) movably mounted on said bar (4), an articulated joint (12) for supporting surgical elements (2), placed at an end of the turret-like support (8a) and angularly movable relative to the outer casing (9), a single locking device (15) being provided for securing the outer casing (9) to the bar (4) and locking the angular

position of the articulated joint (12), which device comprises a cam (17) movably supported by the outer casing (9) and placed between the bar (4) and the articulated joint (12) and having a forcing position at which the bar (4) and the articulated joint (12) are both locked by pressing, a single drive member (16) being also provided for operating the cam (17).



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[0024] Bar 4 has circular sections the centre of which is on the longitudinal axis 5 and comprises a first and a second lengths 4a and 4b which are coaxial, tubular and mutually telescopic and rotating. The first length 4a is the one having the greater diameter and it incorporates the second length 4b of smaller diameter at least partly.

[0025] Bar lengths 4a and 4b are associated with stop contrivances 6 and 7 for stopping mutual translation and rotation, respectively.

[0026] Translation-stopping contrivances 6 comprise a side cap 6a to be screwed down to a free end of the first length 4a and a long threaded rod 6b internal to the first length 4a and to be screwed down to said first length and to the second length 4b.

[0027] The rotation-stopping contrivances 7 comprise a screw to be inserted into the first length 4a in a direction transverse to the longitudinal axis 5, until engagement of the second length 4b. The screw can be associated with a runner or other device.

[0028] Mounted on bar 4, on the first length 4a and second length 4b respectively, is a first and a second turret-like supports 8a and 8b, supporting the surgical screws 2, as pointed out hereinafter.

[0029] The first turret-like support 8a can be freely positioned relative to the first length 4a, and in fact it is movable in respect of the latter both coaxially and rotatably, irrespective of the mutual positions of lengths 4a, 4b.

[0030] The second turret-like support 8b can be either movable relative to the second length 4b, or fixed to an end of said second length. In fact, for its positioning it takes advantage of the mobility of the second length 4b relative to the first length 4a and the mobility of the first turret-like support 8a relative to the first length 4a.

[0031] Each turret-like support comprises a glass-shaped outer casing 9 having an extension direction 10 passing through a substantially closed bottom 9a and an open mouth 9b. Bar 4 passes through the outer casing 9 at a hole 11 which is close to bottom 9a and directed transversely of the extension direction 10.

[0032] An articulated joint 12 is placed at mouth 9b and it is angularly movable relative to the outer casing 9 and is adapted to provide the surgical screws 2 - and generally the surgical elements mounted on the fixing device 1 - with a large possibility of angular adjustment in position.

[0033] In fact the articulated joint 12 is a ball joint comprising a spherical body 13 integral with a tailpiece 14 projecting from the outer casing 9.

[0034] The surgical screws 2 and clamps 3 are in engagement with the tailpiece 14.

[0035] Fig. 1 shows, by way of example, that clamps 3 are provided with adapter plates 3a capable of being fastened to tailpieces 14 by means of connecting screws 14a.

[0036] Engagement means and relative drive

means are provided for both the turret-like supports 8a, 8b or at least for the first support 8a movable on the first bar length 4a, for fixing position of the outer casing 9 on bar 4, and also engagement means and relative drive means are provided for fixing the angular position of the articulated joint 12.

[0037] All said engagement means are embodied, in particular for the first turret-like support 8a, by a single locking device 15.

[0038] In addition, all said relative drive means are embodied by a single member 16 for the locking device 15.

[0039] The locking device 15 comprises a cam 17 supported by the outer casing 9 and extending between bar 4 and the articulated joint 12 and such movable that, when it is in a forcing position, forced pressing contacts are set up on bar 4 and the articulated joint 12.

[0040] In detail, cam 17 is rotating and engages a tie rod 18, better specified in the following, so that when the cam rotates from an inactive position to said pressing position, tie rod 18 is moved from a rest position, where the same is freely oscillating, to a work position, at which the articulated joint 12 and bar 4 are in a fixed position with respect to the turret-like support 8a.

[0041] In the embodiment shown, for obtaining simultaneous and identical sure locking actions, tie rod 18 acts in a direct manner only on the articulated joint 12, dragging the same along and forcing it towards bar 4 until both the articulated joint 12 and bar 4 are locked.

[0042] Tie rod 18 is of tubular form and partly incorporates the spherical body 13 at one end thereof, taking a substantially bell-shaped conformation on the whole.

[0043] Then a counter-block 19 is provided between the spherical body 13 and bar 4 and it can be stressed to compression between them when the bell-shaped tie rod 18 drags along the spherical body 13 towards bar 4.

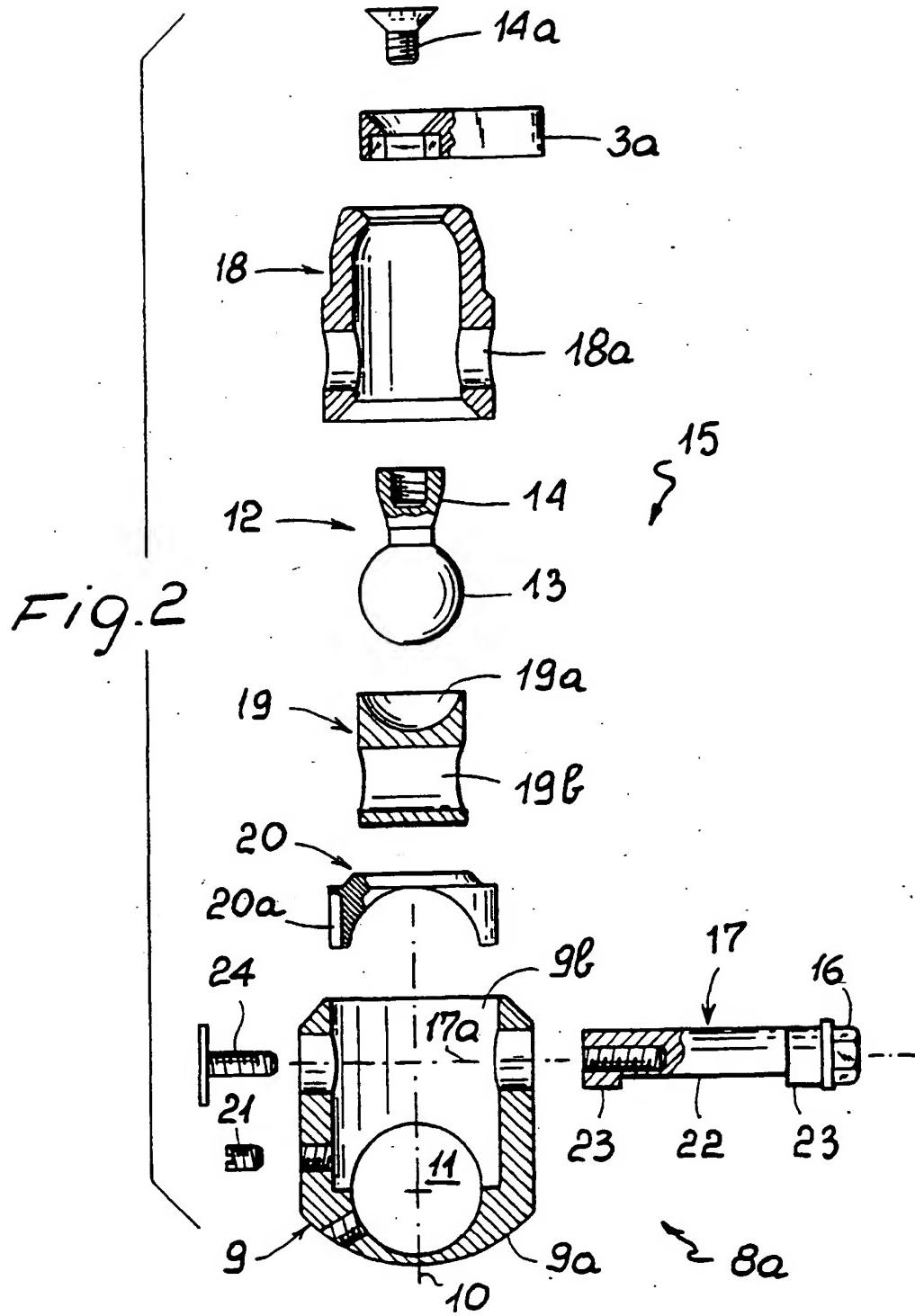
[0044] Counter-block 19 directly engages with the spherical body 13, and its shape matches that of said spherical body at an end cavity 19a, while it is in engagement with bar 4 upon interposition of a saddle-shaped coupling 20 conforming in shape to the bar itself.

[0045] Practically, when the bell-shaped tie rod 18 drags along the spherical body 13 towards bar 4, the counter-block 19 is compressed between the spherical body 13, on the one hand, and the saddle-shaped coupling 20 and bar 4, on the other hand.

[0046] The saddle-shaped coupling 20 is guided to its correct position by a guide dowel 21 to be inserted into a groove 21a. The guide dowel is necessary when turret 8a is mounted externally of bar 4.

[0047] Cam 17 is preferably embodied by a shaped pin rotating under the action of said drive member 16 around a rotation axis 17a. The rotation axis 17a of the cam or shaped pin 17 is transverse to the extension direction 10 of the outer casing 9 of the first turret-like support 8a. The cam or shaped pin 17 has a central

- axis (5), at least one turret-like support (8a) having an outer casing (9) movably mounted on said bar (4), engagement means and relative drive means for fastening said outer casing (9) to said bar (4), at least one articulated joint (12) for supporting surgical elements (2) connected to said turret-like support (8a) and angularly movable relative to said outer casing (9), and engagement means and relative drive means for locking the angular position of said articulated joint (12).
- characterised in that, in order to secure said outer casing (9) to said bar (4) and lock the angular position of said articulated joint (12), a single locking device (15) is provided which comprises at least one cam (17) movably supported by said outer casing (9) and placed between said bar (4) and articulated joint (12) and showing a forcing position at which said bar (4) and articulated joint (12) are both locked by pressing,
- and in that a single drive member (16) active on said cam (17) is provided for operating said locking device (15).
2. A fixing device as claimed in Claim 1, wherein said locking device (15) comprises a tie rod (18) extending between said cam (17) and said articulated joint (12), said tie rod (18) being shiftable from said cam (17) between a rest position, at which said articulated joint (12) is oscillating, and a work position, at which said articulated joint (12) is held to a fixed position by said tie rod (18).
3. A fixing device as claimed in Claim 2, wherein said articulated joint (12) comprises a spherical body (13) and wherein said tie rod (18) is of tubular configuration and partly incorporates said spherical body (13).
4. A fixing device as claimed in Claim 2, wherein said locking device (15) comprises a counter-block (19) inserted between said articulated joint (12) and bar (4), and wherein said tie rod (18) is adapted to forcibly drag along said articulated joint (12) towards said bar (4) until said counter-block (19) is tightened and stressed to compression between said articulated joint (12) and bar (4) and to lock them by pressing.
5. A fixing device as claimed in Claim 4, wherein said counter-block (19) has a shape substantially matching said articulated joint (12) and can be directly engaged by said joint, and wherein a saddle-like coupling (20) substantially conforming in shape to said bar (4) is inserted between said counter-block (19) and bar (4).
6. A fixing device as claimed in Claim 4, wherein said cam (17) is a shaped rotating pin defining a rotation axis (17a) and passing through said counter-block (19) with play, and wherein said shaped pin has ends (23) coaxial with said rotation axis (17a) and rotatably supported by said outer casing (9), and at least one eccentric portion (22) placed between said ends (23) and engaging said tie rod (18).
- 10 7. A fixing device as claimed in Claim 6, wherein said eccentric portion (22) has, perpendicularly to said rotation axis (17a), a circular section offset relative to said rotation axis (17a).
- 15 8. A fixing device as claimed in Claim 1, wherein said cam (17) is a shaped pin rotatably supported by said outer casing (9) and wherein said drive member (16) is a head of said shaped pin projecting from said outer casing (9) and operable by a spanner.
- 20 9. A fixing device as claimed in Claim 1, wherein said outer casing (9) is glass-shaped and has a bottom (9a), an open mouth (9b) and an extension direction (10) passing through said bottom (9a) and open mouth (9b), wherein said bar (4) passes through said outer casing (9) at said bottom (9a), and wherein said articulated joint (12) is located at said open mouth (9b).
- 25 10. A fixing device as claimed in Claim 1, wherein said bar (4) has circular sections and comprises a first and a second lengths (4a, 4b) coaxial and telescopic with each other and mutually rotating, and stop contrivances for stopping translation and rotation (6, 7) between said first and second bar lengths (4a, 4b).
- 30 11. A fixing device as claimed in Claim 1, wherein said turret-like support (8b) is movable coaxially of said bar (4) and rotating about said longitudinal axis (5), in the absence of locking.
- 35 12. A fixing device as claimed in Claim 10, wherein provision is made for a first turret-like support (8a) to be adjustably positioned relative to said first length (4a) of said bar (4) and a second turret-like support (8b) fixed to said second length (4b), at an end of said bar (4).
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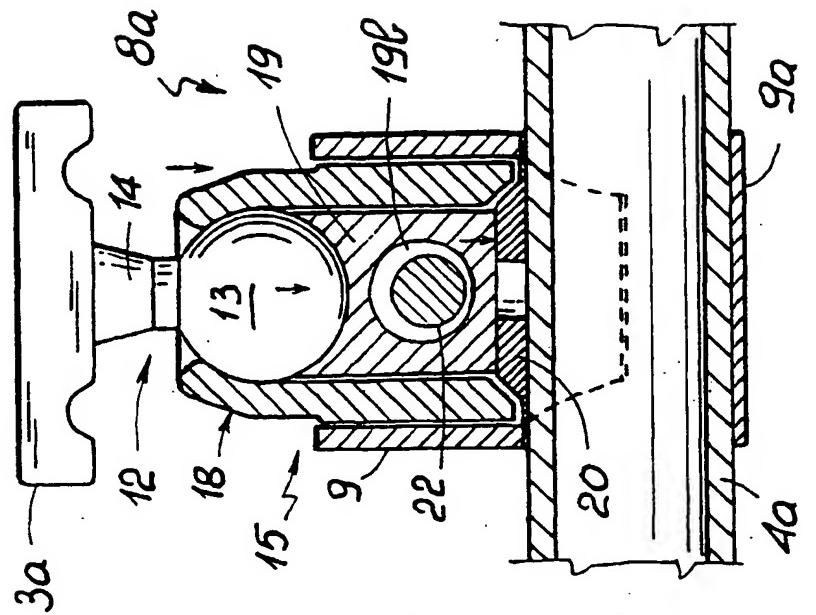


Fig. 6

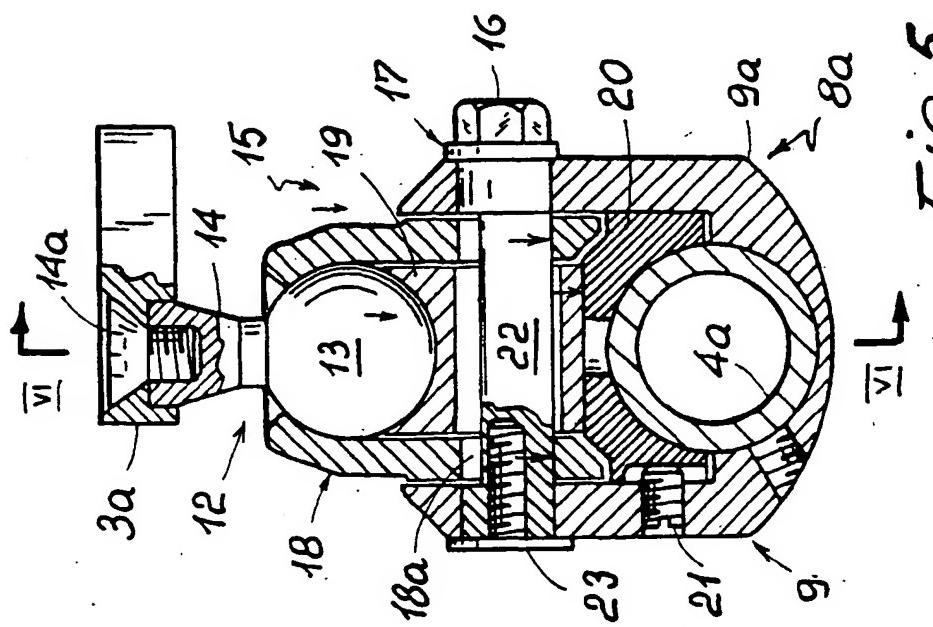


Fig. 5



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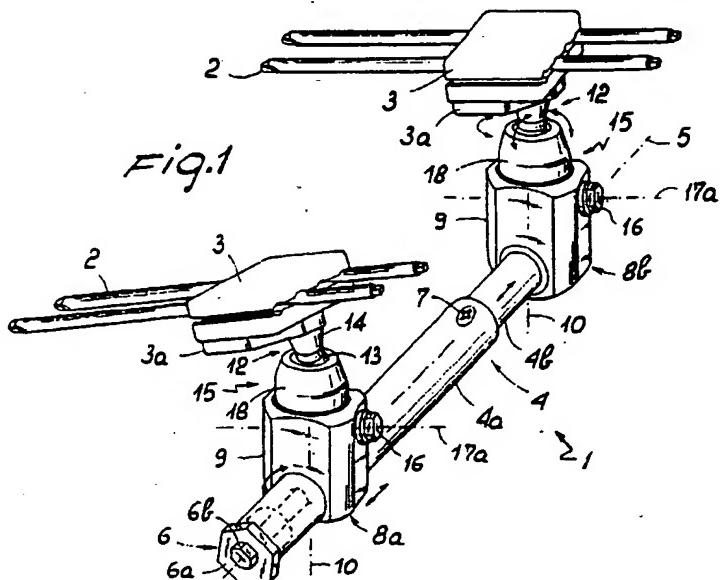
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outer casing (9) to the bar (4) and locking the angular position of the articulated joint (12), which device comprises a cam (17) movably supported by the outer casing (9) and placed between the bar (4) and the articulated joint (12) and having a forcing position at which the bar (4) and the articulated joint (12) are both locked by pressing, a single drive member (16) being also provided for operating the cam (17).



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